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FORM PTO-1390 (REV 10-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 6474-02WOUS
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (If known, see 37 CFR 1.5) <b>09/743589</b>
INTERNATIONAL APPLICATION NO. PCT/DK99/00401	INTERNATIONAL FILING DATE 13 JULY 1999 (13/07/99)	PRIORITY DATE CLAIMED 14 JULY 1998 (14/07/98)	
TITLE OF INVENTION NITS SEPARATOR			
APPLICANT(S) FOR DO/EO/US Birger Elmgaard Sorensen			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)). 4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (PCT Article 31). 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input checked="" type="checkbox"/> has been communicated by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(3)). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input checked="" type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 			
Items 11 to 16 below concern document(s) or information included:			
11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input checked="" type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input type="checkbox"/> Other items or information: Form PCT/IB/308			
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Form PTO-1390 (REV 10-2000) page 2 of 2

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of: )  
Birger E. Sorensen )  
Title: NITS SEPARATOR )  
Serial No.: NEW )  
Filed On: HERewith ) (Our Docket No.: 6474-02WOUS)

Hartford, Connecticut, January 11, 2001

Box PCT  
Assistant Commissioner of Patents  
Washington, D.C. 20231

PRELIMINARY AMENDMENT

S I R:

Upon entry of the above-identified international application into the  
U.S. national stage and before prosecution on the merits, the following amendments  
are requested to place the specification and claims into better U.S. form.

In the Specification: The attached Substitute Specification pages 1-11 incorporate  
amendments included in the annexes of the International Preliminary Examination  
Report under Article 36 as well as further amendments to place the specification into  
better U.S. form. Please substitute the attached Substitute Specification pages 1-11  
for the Corrected English Translation of the specification filed with the International  
Bureau of WIPO on July 14, 2000.

In the Claims: Amendments to the claims are made in relation to the corrected English translation of the claims filed with the International Bureau of WIPO on July 14, 2000.

Claim 1, lines 11-12, delete "characterised in that" and substitute --wherein--.

Claim 2, line 1, delete "characterised in that" and substitute --wherein--.

Claim 3, line 1, delete "or 2, characterised in that" and substitute --wherein--.

Claim 4, line 1, delete ", 2 or 3, characterised in that" and substitute --wherein--.

Claim 5, lines 1-2, delete " any of the claims 1-4, characterised in that" and substitute -- claim 1 wherein--.

Claim 6, lines 1-2, delete " any one of the claims 1-5, characterised in that" and substitute -- claim 1 wherein--.

Claim 7, lines 1-2, delete " any one of the claims 1-5, characterised in that" and substitute -- claim 1 wherein--.

Claim 8, line 1, delete "characterised in that" and substitute --wherein--.

Claim 9, line 1, delete "characterised in that" and substitute --wherein--.

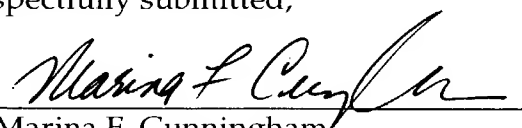
Claim 10, lines 1-2, delete " any one of the claims 1-5, characterised in that" and substitute -- claim 1 wherein--.

In the Abstract: Please delete all reference numerals.

#### REMARKS

Applicant believes no fee is due for filing this amendment, however, if it is determined that a fee is required, please charge deposit account no. 13-0235.

Respectfully submitted,

By   
Marina F. Cunningham  
Registration No. 38,419  
Attorney for Applicant

McCormick, Paulding & Huber LLP  
CityPlace II, 185 Asylum Street  
Hartford, CT 06103-4102  
(860) 549-5290

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1

PCT/DK99/00401

Substitute Specification (pages 1-11).

Docket No. 6474-02WOUS

09/743589  
JC07 Rec'd PCT/PTO 11 JAN 2007

**Nits Separator**

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## FIELD OF THE INVENTION

5 The invention relates to a plant for producing a nonwoven fibre web out of a fibrous material and which comprises a defibrator, such as a hammer mill, for forming the fibre web on a endless forming wire which, when in operation, mostly runs horizontally, a first transport fan which transports defibrated  
10 fibres via a first duct to a forming head, and a second transport fan which extracts nits from the forming head.

Nits are knots, which occur in the defibrated fibrous material as a result either of incomplete defibration in the defibrator,  
15 during transport to the forming head or during the processes which take place within the forming head.

Nits impair the quality of the finished fibre product. Conventionally, the nits are removed by extracting them from  
20 strategic locations within the forming head and returning the extracted material to the hammer mill where the nits are opened to singular fibres and then returned to the forming head.

Achieving a sufficiently high quality finished fibre product  
25 presupposes that all the nits are extracted. However, this requires such an efficient extraction that extraction of a significant amount of well-opened fibres is inevitable. This means that, in practice, by far the greatest part of the extracted material consists of well-opened fibres.

30

To ensure that the nits are entirely removed, the total quantity of extracted fibre material is large and the defibrator is thus subjected to significant extra load.

The extra load, which may account for up to 50% of total power consumption, thus significantly reduces the defibrator's useful capacity to defibrate new fibre material.

5

The defibrator is often a bottleneck in any given plant and, where this is the case, the above-mentioned reduction in the useful capacity of the defibrator prevents 100% utilization of the remainder of the plant. The total operating costs are  
10 increased correspondingly.

The large quantity of re-circulated fibre material in itself causes great wear and tear on the defibrator. Furthermore, practical experience has shown that the fibre material does not  
15 flow evenly across the whole width of, for example, a hammer mill but tends rather to concentrate in certain areas around the rotor, gradually wearing traces in the rotor which must then be repaired.

20 Another disadvantage connected to the above-mentioned conventional method for removing nits from the forming head and convert them in the defibrator is that large quantities of well-opened fibre travelling through the process alongside the nits are shortened to some degree during the defibration  
25 process, thus diminishing the quality of the finished fibre product.

The air streams, which transport fibre material around the plant, form a unified system, which is difficult to control.

30

As mentioned above, the fibrous material containing nits extracted from the forming head is transported back to the defibrator where it is treated along with new material. At the

end of this process, the extracted material is transported back to the forming head on the same air stream as the new fibre material. This air stream is constantly supplied with fresh air sucked into the defibrator, which works therefore under negative pressure. At the same time, air is sucked out of the forming head via the forming wire.

The system concerned is therefore an interconnected system in which extraction from the forming head can easily be disrupted by changes to the hammer mill parameters. This is due to the fact that the negative pressure in the hammer mill changes correspondingly. A change to these operative parameters demands a great deal of adjustment in order to ensure that the plant always is acting optimally.

#### BACKGROUND ART

From the patent application WO 8703626 A1 is known a plant for producing nonwoven web of fibres by air laying the fibres by means of a forming head. The fibres are by a fan transported from a defibrator to the forming head via a conduit.

The main current form the defibrator to the forming head is passing a screen for separating nits from acceptable fibres.

Therefore, the screen needs to have very large dimensions for being able to treat such large quantities of material. The invested capital in a plant of WO 8703626 A1 therefore of necessary will be rather high.

Also, the process of this known plant is uneconomical because the large quantities of energy, which need to be used for



driving the main current through the large screen for only separating the few percent of nits in the main current.

The quality of the resulting product from a plant according to  
5 WO 8703626 A1 also will be poor as the nits in this plant are separated from a large current having a low percent-of nits, as in D1.

Moreover, it is not possible to obtain a product which is  
10 essential free from nits when trying to separate nits in the main current, as nits afterwards are produced during the pneumatic transport to the forming head and during the process in this.

15 When separation the nits from the main stream not only nits are separated but also well-opened fibres are separated and that in a quantity, which will be much larger than the quantity of the separated nits. These separated well opened fibres are together with the separated nits returned to the defibrator subjecting  
20 this to heavy load. As the defibrator normally is the bottleneck of the plant said draw back results in that the difibrator need to be dimensioned with an oversize. That means that the plant of D1 also by this reason will be more costly in investment and more costly to operate than a similar plant  
25 according to the present invention.

Furthermore, the well-opened fibres, which are returned to the defibrator will be shortened whereby the fibre product will obtain a poor quality.

## SUMMARY OF THE INVENTION

A first object of the invention is to provide a plant of the kind mentioned in the opening paragraph, which can function  
5 with lower energy consumption than hitherto known.

A second object of the invention is to provide a plant of the kind mentioned in the opening paragraph, which better than hitherto known is able to produce a high quality product  
10 without nits and shortened fibres.

A third object of the invention is to provide a plant of the kind mentioned in the opening paragraph, which is easier to keep in a controlled condition than hitherto known.  
15

A fourth object of the invention is to provide a plant of the kind mentioned in the opening paragraph which is arranged in such a way that the load on the defibrator is more even, that the defibrator is subjected to less wear and tear and that its  
20 capacity is utilised more efficiently than hitherto known.

What is new and characteristic of the invention and ensures that these improvements are achieved is that the plant also includes a separator, connected to the second air duct, for  
25 separating nits and well-opened fibres.

This arrangement ensures that the large quantities of nits and defibrated fibres extracted from the forming head are channelled past the defibrator, which can then be utilised  
30 exclusively for defibration of new material. This saves the energy used by conventional plants to treat the extracted material in the defibrator. Furthermore, the defibrator is allowed to work with a constant, even load and is not subject

to the kind of wear and tear to which, for example, a hammer mill rotor has hitherto been subjected.

As at least some of the well-opened fibres are conveyed past the defibrator and do not come into contact with the airborne stream of defibrated fibrous material in it, the air stream in the plant are more easily controlled, avoiding the disadvantages associated with adjusting conventional plants.

One further advantage is that the finished fibre product achieves optimum high quality, because the fibres are not shortened by the defibrator, and in consequence of that, all the nits are in addition sucked up without causing load on the defibrator with the large quantities of well-opened fibres which are extracted along with the nits when a complete nits extraction is sought.

The separated, well-opened fibres may be collected in a suitable way for later use. However, this material can with advantage be returned to the forming head by means of a third transport fan and a third air duct.

Furthermore, the separated nits can be removed from the nits separator by means of a fourth transport fan inserted in a fourth air duct, which in one embodiment can be connected to the defibrator.

As the separated nits account only for a minor part of the fibrous material sucked away from the forming head, the advantages achieved by using a plant of the kind described in accordance with the invention can partly be maintained even if the separated nits are transported directly to the defibrator for being defibrated there.

In one advantageous embodiment the plant may include a separate nits-opener, the purpose of which is to turn the separated nits into well-opened fibres. The advantage inherent in this construction is that the defibrator is not subject to the strain of the separated nits.

In this case, the fourth air duct may extend between the nits separator and the nits-opener, which may also be connected to the forming head via a fifth air duct with a fifth transport fan for returning the opened nits to the forming head, so that, the separated nits, which are opened in the nits-opener, are channelled in a circuit past the defibrator.

The nits-opener and the nits separator can both be constructed in any suitable way. The nits-opener may, for example, be a hammer mill or, alternatively, a refiner to defibrate the nits either between two grinding discs or on a card. The nits separator may be a forming head, a cyclone or an air screen.

#### BRIEF DESCRIPTION OF THE DRAWING

The invention will be explained more fully by the following description of an embodiment, which just serves as an example, and with reference to the only figure of the drawing.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The plant includes a number of transport fans. These are drawn with dotted lines to indicate that one or several of these transport fans may be omitted in special variations of the construction shown.

The main components of the plant in the case shown are a known hammer mill 1, an existing forming head 2, an existing forming wire 3, which is mounted underneath the forming head, a nits separator 4 and a nits-opener 5.

5

Fibre material, which in this example is assumed to be cellulose pulp, is fed to the hammer mill 1 on a roller 6. The pulp is, in a known way, defibrated into single fibres in the hammer mill by means of a rotor 7, which has hinged swingles 8  
10 and is rotating during operation.

By means of a first transport fan 9 and via a first duct 10, the fibres are channelled to the forming head 2 on an air stream, which is formed as the hammer mill, in the direction of  
15 the arrow, is supplied with air via an air intake 11.

The forming head 2 shown comprises mainly a housing 12 with a perforated base 13 and a number of rotors 14 with wings 15 mounted above the base.

20

The forming wire 3 comprises an endless, air permeable belt which runs over a number of idle rolls 16, which in the example shown are four, and a driving roll 17. A suction box 18 is mounted underneath the forming wire with a fan 19 to create a  
25 negative pressure in the suction box.

During operation, the fibres supplied to the forming head 2 over the perforated base 15 are distributed by means of the wings 15 on the rotating rotors 14.

30

The negative pressure in the suction box 18 generates a stream of air across the base and forming wire 2. This stream of air

gradually pulls the fibres down onto the forming wire via the openings in the perforated base 13.

5 The forming wire will normally consist of a mesh net whose mesh size ensures that the majority of the fibres form a web 20 on the upper side of the forming wire while the air streams past into the suction box 18.

10 The forming wire transports the web of fibres further along in the direction indicated by the arrow for treatment in the later stages of the process in the plant (not shown).

15 Nits are knots in the defibrated fibre material, formed in the hammer mill during transport to the forming head and during the process, which takes place there. The nits diminish the quality of the finished fibre product and are therefore removed from the forming head in the normal way via a second air duct 21 with a second transport fan 22.

20 A high quality of the finished fibre product requests that the product contains no nits at all, which is why the nits must be removed completely from the forming head before they reach the point at which they are swept along by the air stream through the base of the forming head.

25 A strong air stream is needed for efficient extraction of the nits. This strong air stream will unavoidably also suck away large quantities of well-opened fibres at the same time. In practice, significantly more well-opened fibres is sucked up  
30 through the second air duct 21 than nits.

The nits and the well-opened fibres are channelled via the second air duct 21 to the nits separator 4. This separator may,

for example, be a small forming head (not shown) which can easily be adjusted for this specific purpose.

5           5    It is an advantage if the extraction beneath the forming head is just strong enough to ensure that the nits are separated with an optimum concentration of nits in the extracted material. Strong suction may mean that there is a small quantity of nits in the mass of separated well-opened fibres. This is; however, not crucial as the nits are again caught in  
10       10   the forming head and subsequently once more subjected to the separation process in the nits separator.

Alternatively, the nits separator may, however, be a cyclone (not shown) or an air separator (not shown).

15       15   The separated, well-opened fibres are removed from the nits separator by means of a third transport fan 23 and are returned to the forming head via a third air duct 24 without being shortened or otherwise damaged like in a conventional plant.

20       20   The separated nits are extracted from the nits separator by means of a fourth transport fan 25 via a fourth air duct 26, connected to the nits-opener 5. The nits-opener may; for example, be a small hammer mill (not shown) or a refiner (not  
25       25   shown) to defibrate the nits between two grinding discs or on a card (not shown).

Having been opened in the nits-opener, the now well-opened fibres are channelled back to the forming head 2 via a fifth  
30       air duct 27 by means of a fifth transport fan 29. In the drawing the third and fifth air ducts 24;27 are joined at their connection to the forming head. These two air ducts 24;27 may

Nits Separator

The invention relates to a plant for producing a nonwoven fibre web out of a fibrous material and which comprises a defibrator, such as a hammer mill, for forming the fibre web on a endless forming wire which, when in operation, mostly runs horizontally, a first transport fan which transports defibrated fibres via a first duct to a forming head, and a second transport fan which extracts nits from the forming head.

Nits are knots, which occur in the defibrated fibrous material as a result either of incomplete defibration in the defibrator, during transport to the forming head or during the processes which take place within the forming head.

Nits impair the quality of the finished fibre product. Conventionally, the nits are removed by extracting them from strategic locations within the forming head and returning the extracted material to the hammer mill where the nits are opened to singular fibres and then returned to the forming head.

Achieving a sufficiently high quality finished fibre product presupposes that all the nits are extracted. However, this requires such an efficient extraction that extraction of a significant amount of well-opened fibres is inevitable. This means that, in practice, by far the greatest part of the extracted material consists of well-opened fibres.

To ensure that the nits are entirely removed, the total quantity of extracted fibre material is large and the defibrator is thus subjected to significant extra load.

The extra load, which may account for up to 50% of total power consumption, thus significantly reduces the defibrator's useful capacity to defibrate new fibre material.



The defibrator is often a bottleneck in any given plant and, where this is the case, the above-mentioned reduction in the useful capacity of the defibrator prevents 100% utilisation of the remainder of the plant. The total operating costs are increased correspondingly.

The large quantity of re-circulated fibre material in itself causes great wear and tear on the defibrator. Furthermore, practical experience has shown that the fibre material does not flow evenly across the whole width of, for example, a hammer mill but tends rather to concentrate in certain areas around the rotor, gradually wearing traces in the rotor which must then be repaired.

Another disadvantage connected to the above-mentioned conventional method for removing nits from the forming head and convert them in the defibrator is that large quantities of well-opened fibre travelling through the process alongside the nits are shortened to some degree during the defibration process, thus diminishing the quality of the finished fibre product.

The air streams, which transport fibre material around the plant, form a unified system, which is difficult to control.

As mentioned above, the fibrous material containing nits extracted from the forming head is transported back to the defibrator where it is treated along with new material. At the end of this process, the extracted material is transported back to the forming head on the same air stream as the new fibre material. This air stream is constantly supplied with fresh air sucked into the defibrator, which works therefore under negative pressure. At the same time, air is sucked out of the forming head via the forming wire.

The system concerned is therefore an interconnected system in which extraction from the forming head can easily be disrupted by changes to the hammer mill parameters. This is due to the fact that the negative pressure in the hammer mill changes correspondingly. A change to these operative parameters demands a great deal of adjustment in order to ensure that the plant always is acting optimally.

From the patent application WO 8703626 A1 is known a plant for producing nonwoven web of fibres by air laying the fibres by means of a forming head. The fibres are by a fan transported from a defibrator to the forming head via a conduit.

The main current from the defibrator to the forming head is passing a screen for separating nits from acceptable fibres.

Therefore, the screen needs to have very large dimensions for being able to treat such large quantities of material. The invested capital in a plant of WO 8703626 A1 therefore of necessary will be rather high.

Also, the process of this known plant is uneconomical because the large quantities of energy, which need to be used for driving the main current through the large screen for only separating the few percent of nits in the main current.

The quality of the resulting product from a plant according to WO 8703626 A1 also will be poor as the nits in this plant are separated from a large current having a low percent of nits, as in D1.

Moreover, it is not possible to obtain a product which is essential free from nits when trying to separate nits in the main current, as nits afterwards are produced during the pneumatic transport to the forming head and during the process in this.

When separation the nits from the main stream not only nits are separated but also well-opened fibres are separated and that in a quantity, which will be much larger than the  
5 quantity of the separated nits. These separated well opened fibres are together with the separated nits returned to the defibrator subjecting this to heavy load. As the defibrator normally is the bottleneck of the plant said draw back results in that the difibrator need to be dimensioned with an  
10 oversize. That means that the plant of D1 also by this reason will be more costly in investment and more costly to operate than a similar plant according to the present invention.

Furthermore, the well-opened fibres, which are returned to the  
15 defibrator will be shortened whereby the fibre product will obtain a poor quality.

A first object of the invention is to provide a plant of the kind mentioned in the opening paragraph, which can function  
20 with lower energy consumption than hitherto known.

A second object of the invention is to provide a plant of the kind mentioned in the opening paragraph, which better than hitherto known is able to produce a high quality product  
25 without nits and shortened fibres.

A third object of the invention is to provide a plant of the kind mentioned in the opening paragraph, which is easier to keep in a controlled condition than hitherto known.  
30

A fourth object of the invention is to provide a plant of the kind mentioned in the opening paragraph which is arranged in such a way that the load on the defibrator is more even, that the defibrator is subjected to less wear and tear and that its  
35 capacity is utilised more efficiently than hitherto known.

What is new and characteristic of the invention and ensures that these improvements are achieved is that the plant also includes a separator, connected to the second air duct, for separating nits and well-opened fibres.

5

This arrangement ensures that the large quantities of nits and defibrated fibres extracted from the forming head are channelled past the defibrator, which can then be utilised exclusively for defibration of new material. This saves the energy used by conventional plants to treat the extracted material in the defibrator. Furthermore, the defibrator is allowed to work with a constant, even load and is not subject to the kind of wear and tear to which, for example, a hammer mill rotor has hitherto been subjected.

15

As at least some of the well-opened fibres are conveyed past the defibrator and do not come into contact with the airborne stream of defibrated fibrous material in it, the air stream in the plant are more easily controlled, avoiding the disadvantages associated with adjusting conventional plants.

20

One further advantage is that the finished fibre product achieves optimum high quality, because the fibres are not shortened by the defibrator, and in consequence of that, all the nits are in addition sucked up without causing load on the defibrator with the large quantities of well-opened fibres which are extracted along with the nits when a complete nits extraction is sought.

25

The separated, well-opened fibres may be collected in a suitable way for later use. However, this material can with advantage be returned to the forming head by means of a third transport fan and a third air duct.

30

Furthermore, the separated nits can be removed from the nits separator by means of a fourth transport fan inserted in a

35

fourth air duct, which in one embodiment can be connected to the defibrator.

As the separated nits account only for a minor part of the fibrous material sucked away from the forming head, the advantages achieved by using a plant of the kind described in accordance with the invention can partly be maintained even if the separated nits are transported directly to the defibrator for being defibrated there.

In one advantageous embodiment the plant may include a separate nits-opener, the purpose of which is to turn the separated nits into well-opened fibres. The advantage inherent in this construction is that the defibrator is not subject to the strain of the separated nits.

In this case, the fourth air duct may extend between the nits separator and the nits-opener, which may also be connected to the forming head via a fifth air duct with a fifth transport fan for returning the opened nits to the forming head, so that, the separated nits, which are opened in the nits-opener, are channelled in a circuit past the defibrator.

The nits-opener and the nits separator can both be constructed in any suitable way. The nits-opener may, for example, be a hammer mill or, alternatively, a refiner to defibrate the nits either between two grinding discs or on a card. The nits separator may be a forming head, a cyclone or an air screen.

The invention will be explained more fully by the following description of an embodiment, which just serves as an example, and with reference to the only figure of the drawing.

The plant includes a number of transport fans. These are drawn with dotted lines to indicate that one or several of these

transport fans may be omitted in special variations of the construction shown.

5 The main components of the plant in the case shown are a known hammer mill 1, an existing forming head 2, an existing forming wire 3, which is mounted underneath the forming head, a nits separator 4 and a nits-opener 5.

10 Fibre material, which in this example is assumed to be cellulose pulp, is fed to the hammer mill 1 on a roller 6. The pulp is, in a known way, defibrated into single fibres in the hammer mill by means of a rotor 7, which has hinged swingles 8 and is rotating during operation.

15 By means of a first transport fan 9 and via a first duct 10, the fibres are channelled to the forming head 2 on an air stream, which is formed as the hammer mill, in the direction of the arrow, is supplied with air via an air intake 11.

20 The forming head 2 shown comprises mainly a housing 12 with a perforated base 13 and a number of rotors 14 with wings 15 mounted above the base.

25 The forming wire 3 comprises an endless, air permeable belt which runs over a number of idle rolls 16, which in the example shown are four, and a driving roll 17. A suction box 18 is mounted underneath the forming wire with a fan 19 to create a negative pressure in the suction box.

30 During operation, the fibres supplied to the forming head 2 over the perforated base 15 are distributed by means of the wings 15 on the rotating rotors 14.

35 The negative pressure in the suction box 18 generates a stream of air across the base and forming wire 2. This stream of air

gradually pulls the fibres down onto the forming wire via the openings in the perforated base 13.

5 The forming wire will normally consist of a mesh net whose mesh size ensures that the majority of the fibres form a web 20 on the upper side of the forming wire while the air streams past into the suction box 18.

10 The forming wire transports the web of fibres further along in the direction indicated by the arrow for treatment in the later stages of the process in the plant (not shown).

15 Nits are knots in the defibrated fibre material, formed in the hammer mill during transport to the forming head and during the process, which takes place there. The nits diminish the quality of the finished fibre product and are therefore removed from the forming head in the normal way via a second air duct 21 with a second transport fan 22.

20 A high quality of the finished fibre product requests that the product contains no nits at all, which is why the nits must be removed completely from the forming head before they reach the point at which they are swept along by the air stream through the base of the forming head.

25 A strong air stream is needed for efficient extraction of the nits. This strong air stream will unavoidably also suck away large quantities of well-opened fibres at the same time. In practice, significantly more well-opened fibres is sucked up 30 through the second air duct 21 than nits.

The nits and the well-opened fibres are channelled via the second air duct 21 to the nits separator 4. This separator may, for example, be a small forming head (not shown) which 35 can easily be adjusted for this specific purpose.

It is an advantage if the extraction beneath the forming head is just strong enough to ensure that the nits are separated with an optimum concentration of nits in the extracted material. Strong suction may mean that there is a small quantity of nits in the mass of separated well-opened fibres. This is; however, not crucial as the nits are again caught in the forming head and subsequently once more subjected to the separation process in the nits separator.

Alternatively, the nits separator may, however, be a cyclone (not shown) or an air separator (not shown).

The separated, well-opened fibres are removed from the nits separator by means of a third transport fan 23 and are returned to the forming head via a third air duct 24 without being shortened or otherwise damaged like in a conventional plant.

The separated nits are extracted from the nits separator by means of a fourth transport fan 25 via a fourth air duct 26, connected to the nits-opener 5. The nits-opener may, for example, be a small hammer mill (not shown) or a refiner (not shown) to defibrate the nits between two grinding discs or on a card (not shown).

Having been opened in the nits-opener, the now well-opened fibres are channelled back to the forming head 2 via a fifth air duct 27 by means of a fifth transport fan 29. In the drawing the third and fifth air ducts 24;27 are joined at their connection to the forming head. These two air ducts 24;27 may alternatively be separately connected to the forming head (not shown).

An air duct 28, shown with dotted lines, indicates that the hammer mill 1 may be used to defibrate the nits instead of the nits-opener 5, which is then superfluous. This solution may be



advantageous in cases where there is excess capacity in the hammer mill, as the level of required investment is correspondingly reduced.

- 5 The above description and drawing of the invention are based on a plant which comprises one hammer mill 1, one forming head 2, one forming wire 3, one nits separator 4 and one nits-opener 5.
- 10 However, within the scope of the invention, the plant may have any suitable number of the above-mentioned components nos. 1, 2, 3, 4 and 5 and in any combination.

The defibrator does not necessarily have to be a hammer mill  
15 but may equally well be any other kind of suitable defibrator.

Furthermore, the plant can be constructed to pre-treat not only cellulose fibre but also other fibrous materials or a mixture of these.

**Patent claims**

1. A plant for producing a nonwoven web of fibres (20) out of fibrous material and which comprises a defibrator (1), such as a hammer mill, for defibrating the fibre material, and at least one forming head (2) for forming a fibre web (20) on an endless forming wire (3) which, during operation, runs mainly horizontally, a first transport (9) fan for transporting defibrated fibre to the forming head via a first air duct (10), and a second transport fan (22) to extract nits from the forming head via a second air duct (21), **characterised** in that the plant also includes a separator (4), connected to the second air duct (21), for separating nits and well-opened fibres.
2. A plant according to claim 1, **characterised** in that it comprises a third transport fan (23) for returning the separated, well-opened fibres to the forming head via a third air duct (24).
3. A plant according to claim 1 or 2, **characterised** in that it comprises a fourth transport fan (25) to remove the separated nits from the nits separator via a fourth air duct (26).
4. A plant according to claim 1, 2 or 3, **characterised** in that it comprises a nits-opener (5) to convert the separated nits into well-opened fibres.
5. A plant according to claim 4, **characterised** in that the fourth air duct (26) extends between the nits separator (4) and the nits-opener (5) and that this is also connected to the forming head (2) via a fifth air duct (27) with a fifth transport fan (29) for returning the opened nits to the forming head (2).

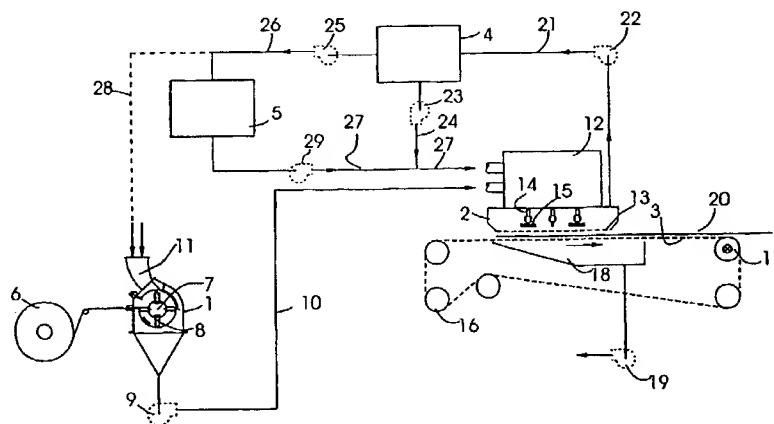
6. A plant according to any one of the claims 1 - 5, **characterised** in that the nits separator (4) is a forming head.
- 5 7. A plant according to any one of the claims 1 - 5, **characterised** in that the nits separator (4) is a cyclone.
8. A plant according to claim 4, **characterised** in that the nits-opener (5) is a hammer mill.
- 10 9. A plant according to claim 4, **characterised** in that the nits-opener (5) is a refiner, designed to defibrate the nits between two grinding discs.
- 15 10. A plant according to any one of the claims 1 - 5, **characterised** in that the nits-opener (5) is constructed in the form of a card.

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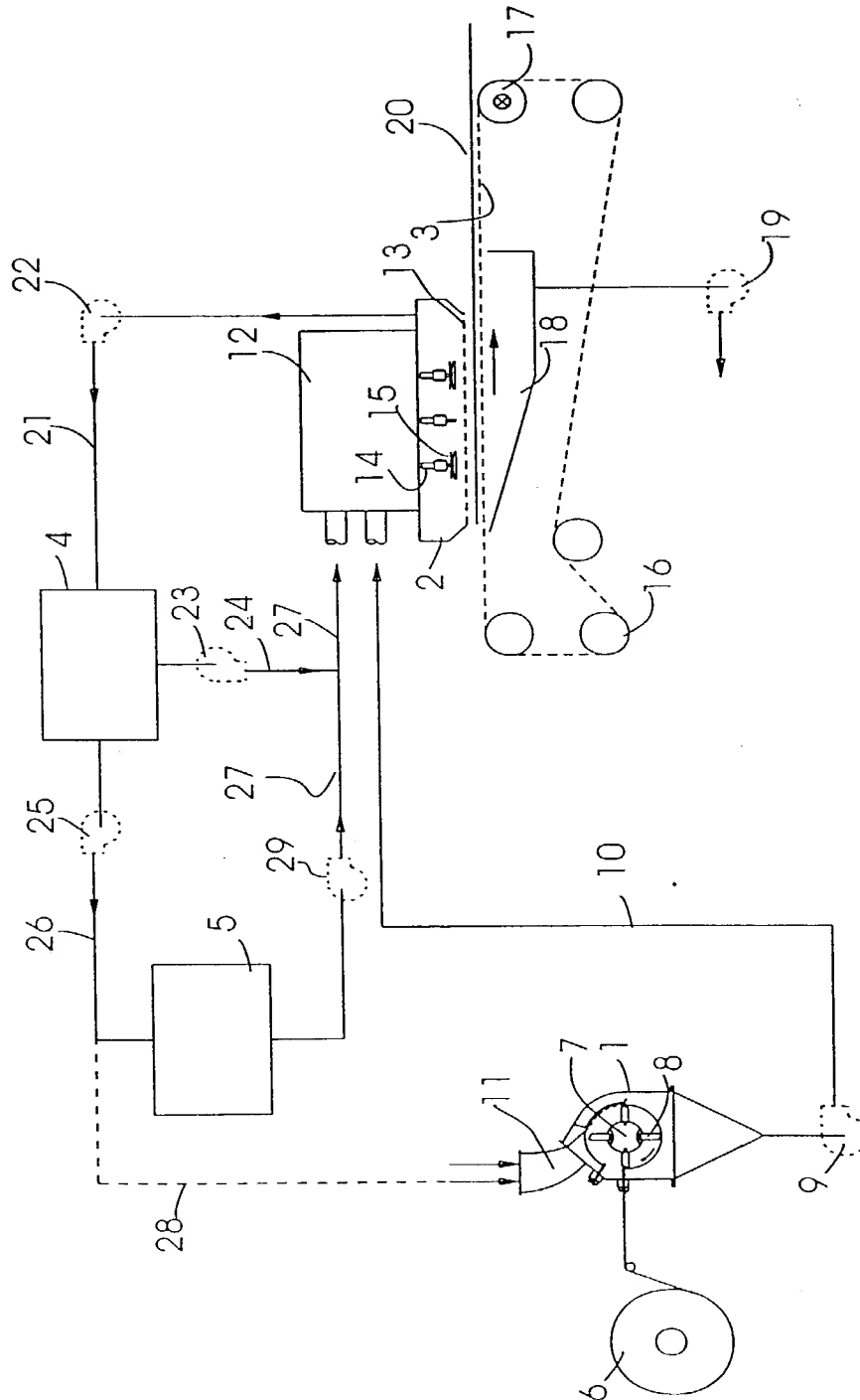
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<b>(21) International Application Number:</b> PCT/DK99/00401 <b>(22) International Filing Date:</b> 13 July 1999 (13.07.99) <b>(30) Priority Data:</b> PA 1998 00933 <u>13 July 1999</u> <u>14 July 1998 (14.07.98)</u> <b>DK</b> <b>(71) Applicant (for all designated States except US):</b> M & J FIBRETECH A/S [DK/DK]; Vejlevej 3, DK-8700 Horsens (DK). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> SØRENSEN, Elmgaard, Birger [DK/DK]; Viemosevej 3, DK-7120 Vejle Ø (DK). <b>(74) Agent:</b> HOLME PATENT A/S; Vesterbrogade 20, DK-1620 Copenhagen V (DK).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Danish).</i>

**(54) Title:** NITS SEPARATOR**(57) Abstract**

A plant which serves to produce a nonwoven web of fibres (20) out of a fibrous material, such as cellulose pulp (6). The plant comprises a hammer mill (1) for defibrating the fibrous material and a forming head (2) for forming a web of fibres on an endless forming wire (3), which, during operation, runs mainly horizontally, a first transport fan (9) for transporting defibrated fibre to the forming head via a first air duct (10) and a second transport fan (22) to extract nits from the forming head via a second air duct (21). Furthermore, the plant comprises one separator (4) (connected to the second air duct) for separating the nits and the well-defibrated fibre and a third transport fan (23) for returning the separated, well-defibrated fibres to the forming head, and a nits defibrator (5) for converting the separated nits into well-defibrated fibre. The separated nits are transported from the nits separator (4) to the nits defibrator (5) by means of a fourth transport fan (25) via a fourth air duct (26). The defibrated fibres are returned to the forming head by means of a fifth transport fan (29) via a fifth air duct (27). The plant is easy to control and is capable of producing optimally high quality fibre products. In addition, the plant allows the defibrator to defibrate new fibre material at full capacity so that the remainder of the plant is able to produce at an optimum output level. The plant is furthermore very energy-saving.

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## DECLARATION, POWER OF ATTORNEY AND APPOINTMENT OF DOMESTIC REPRESENTATIVE

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled Nits Separator

the specification of which

(Check      is attached hereto.

one) \_\_\_\_\_ was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_ and  
was amended on \_\_\_\_\_  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §§1.56 and 1.63(d).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

### Prior Foreign Application(s)

**Priority  
Claimed**

PA 1998 00933      Denmark      14 July 1998  
(Number)                      (Country)                      (Day/Month/Year Filed)

<u>X</u>	<u>      </u>
Yes	No

(Number)	(Country)	(Day/Month/Year Filed)
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Yes      No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States Provisional Application(s) listed below:

		<u>Priority Claimed</u>
<u>(Number)</u>	<u>(Filing Date)</u>	<u>Yes</u> <u>No</u>

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §§1.56 and 1.63(d) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

<u>PCT/DK99/00401</u>	<u>13 July 1999</u>	<u>Pending</u>
(Application Serial No.)	(Filing Date)	(Status)(Patented, Pending, Abandoned)

#### POWER OF ATTORNEY

I hereby appoint THEODORE R. PAULDING, Registration No. 19,294 - DONALD K. HUBER, Registration No. 18,686 - JOHN C. HILTON, Registration No. 22,965 - FREDERICK J. HAESCHE, Registration No. 24,529 - JOHN C. LINDERMAN, Registration No. 24,420 - J. KEVIN GROGAN, Registration No. 31,961 - ARTHUR F. DIONNE, Registration No. 23,093 - RICHARD MICHAUD, Registration No. 40088 - DANIEL G. MACKAS, Registration No. 38,541 - MARINA F. CUNNINGHAM, Registration No. 38,419 - PETER J. RAINVILLE, Registration No. 41,263 - MICHAEL T. CLORITE, Registration No. 44,620 - NICHOLAS J. TUCCILLO, Registration No. 44,322 - DANIEL M. BARBIERI - Registration No. P46,215 - Wm. TUCKER GRIFFITH, Registration No. 44,726 - STEPHEN P. SCUDERI, Registration No. 42,136 - MARY-JACQ HOLROYD, Registration No. 41,846 - ANTHONY D. WILSON, Registration No. 45,223 - SUSAN C. OYGARD, Registration No. P42,969 all of the firm of McCORMICK, PAULDING & HUBER LLP, CityPlace II, 185 Asylum Street, Hartford, Connecticut 06103-4102, Telephone No. (860) 549-5290, as my attorneys to prosecute this application, to make alterations and amendments therein, to receive the patent and all correspondence relating to this application, and to transact all business in the U. S. Patent and Trademark Office connected therewith, and the said attorneys are hereby given full power of substitution and revocation.

(19)

APPOINTMENT OF DOMESTIC REPRESENTATIVE

The above-identified attorneys, also known as McCORMICK, PAULDING & HUBER LLP, whose postal address is CityPlace II, 185 Asylum Street, Hartford, Connecticut 06103-4102, United States of America, are hereby designated applicant's representative upon whom notices or process in proceedings affecting the patent may be served. Said firm shall take instructions from my foreign patent agents in all matters affecting this application and the patent.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

100 Birger Elmgaard Sørensen

Full name of first inventor

Full Name of second inventor

*Birger Sørensen*  
Inventor's Signature

Inventor's Signature

*January 8th - 2001* DK  
Date Citizenship

Date Citizenship

Viemosevej 3, DK-7120 Vejle Ø  
Residence Address

Residence Address

Viemosevej 3, DK-7120 Vejle Ø  
Post Office Address

Post Office Address